भारतीय मानक
Indian Standard

IS 9034 : 2018

मोटर वाहन और अन्य उपकरणों की प्राइमड सतहों पर इस्तेमाल के लिए वायु शष्कन, इनैमल, सिंथेटिक, बाहरी, के लिए विशिष्टि

(पहला पुनरीक्षण)

Enamel, Synthetic, Exterior, Air Drying, for Use on Primed Surfaces of Motor Vehicles and Other Equipment — Specification

(First Revision)

ICS 87.040

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली-110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.org.in www.standardsbis.in

July 2018 **Price Group 6**

Paints, Varnishes and Related Products Sectional Committee, CHD 20

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Paints, Varnishes and Related Products Sectional Committee had been approved by the Chemical Division Council.

This standard was first published in 1964. In the preparation of this standard substantial assistance had been derived from data supplied by Directorate General of Supplies & Disposals, New Delhi. The material to this standard is intended for use by automobile body builders, manufacturers of trailers and for finishing of electrical machines and is resistant to kerosene, water and slight rise in temperature during use.

Revision of this standard has been taken up with a view to incorporate limit of lead restriction in this standard. The Technical Committee responsible for formulation of this standard observed that in practice most of the paints are used for household/decorative as well as in industrial/commercial applications. Taking cognizance of the fact that lead exposure of human being, particularly children, has adverse effect on human health and also adverse impact on environment and safety, the Technical Committee felt the need to introduce different levels of lead restriction in all paint standards likely to be used for household and decorative applications. It was also decided to introduce lead restriction in some of the industrial paints, as far as possible, keeping in view relevance of lead restriction with respect to application condition and service life of the paint and wherever the product corresponding to a particular specification is of such composition that it would be easy to incorporate lead restriction without creating any negative impact.

For synthetic enamel based products naturally occurred extruders/fillers are not used as a part of the constituents. The Technical Committee responsible for the formulation of this standard observed that technologically it is feasible to manufacture this product with low limit of lead. Therefore, it is felt that though in practice this paint is used for industrial coating applications, there is scope for prescribing maximum permissible low limit of lead to avoid hazardous impact of lead exposure to consumers and consequent adverse impact on environment and human health. The committee decided to prescribe maximum permissible limit of lead as 300 ppm for the benefit of applicators. Further, majority of consumers are not aware of the consequences of lead toxicity and its long-term implications to human health. Therefore, in this revision, along with lead restriction, a suitable cautionary notice has been included in the marking clause. Reference has been given to various Parts/Sections of IS 101 for testing the requirements given in the standard substituting reference to IS 197: 1952 ‘Methods of test for varnishes and lacquers)’ (since withdrawn).

The method of test for durability by carbon arc type weathering apparatus has been substituted by a method using xenon arc type weathering apparatus as it is found that carbon arc type weathering apparatus is no more in use.

For satisfactory results, the primer, undercoating and the finishing enamels be preferably obtained from the same manufacturer. For the purpose of testing the primer, undercoating and the finishing enamel shall be obtained from the same source.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ENAMEL, SYNTHETIC, EXTERIOR, AIR DRYING, FOR USE ON PRIMED SURFACES OF MOTOR VEHICLES AND OTHER EQUIPMENT — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard prescribes requirements and methods of sampling and test for the material commercially known as enamel, synthetic, exterior, air drying, for use on primed surfaces of motor vehicles and other equipment.

1.1.1 The material is used for painting systems for protection and decoration of bus bodies, trailers, electrical machines, etc, which come in contact with kerosene, lubricating oils and water and electrical machines which get heated up during use resulting in slight rise in temperature.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definition in addition to those given in IS 1303 shall apply.

3.1.1 *Registered Sample* — Sample supplied in advance by a prospective supplier and registered by the approved testing authorities after testing it to all the requirements of this standard. A complete record of the performance shall be kept in respect of all tests.

4 CLASSES

4.1 The material shall be supplied in brushing consistency but shall be suitable for application by spraying after thinning with suitable thinner as agreed to between the purchaser and the supplier.

4.1.1 The material required, whether undercoating or finishing, shall be clearly specified by the indentor.

5 COLOUR CATEGORIES

5.1 For the purpose of registration of the samples of the material, colour categories given in Table 1 shall be employed.

Table 1 Colour Categories
(*Clause* 5.1)

Colour Category No.	Colour Shade	ISC No. as per IS 5	Shade Recommended for Registration of Samples
(1)	(2)	(3)	(4)
1	White	—	White
2	Black	—	Black
3	Dark violet	796	Dark violet
4	i) Sky blue	101	Turquoise blue
	ii) Turquoise blue	102	
	iii) Oriental blue	174	
	iv Light admiral grey	697	
	v) Phirozi	176	
	vi) Satin blue	177	
5	i) Eau-de-nil	216	Apple green
	ii) Opaline green	275	
	iii) Apple green	281	
	iv) Bus green	299	
6	i) Peacock blue	103	Traffic blue
	ii) Azure blue	104	
	iii) Traffic blue	169	
7	i) Oxford blue	105	Oxford blue
	ii) Navy blue	106	
8	Aircraft blue	108	Aircraft blue
9	French blue	166	French blue
10	i) Sea green	217	Sea green
	ii) Verdigris green	287	
11	i) Sage green	219	Sage green
	ii) Light olive green	278	
	iii) Aircraft grey green	283	
12	i) Grass green	218	Traffic green or Grass green
	ii) Traffic green	267	
	iii) India green	284	
	iv) Brilliant green	221	
13	i) Light brunswick green	225	Middle Brunswick
	ii) Middle brunswick green	226	
	iii) Deep brunswick green	227	
	iv) Lincoln green	276	
	v) Cypress green	277	
	vi) Forest green	282	

Table 1 — (*Concluded*)

(1)	(2)	(3)	(4)
14	i) Olive green	220	
	ii) Light bronze green	222	
	iii) Middle bronze green	223	
	iv) Deep bronze green	224	Olive green
	v) Steel furniture green	279	
	vi) Scamic	294	
	vii) Olive drab	298	
15	Canary yellow	309	Canary yellow
16	i) Lemon	355	Golden yellow
	ii) Golden yellow	356	
17	i) Pale cream	352	
	ii) Deep cream	353	
	iii) Light stone	361	
	iv) Portland stone	364	
	v) Vellum	365	Pale cream
	vi) Light straw	384	or Deep cream
	vii) Light biscuit	385	
	viii) Champagne	386	
	ix) Sunshine	387	
	x) Beige	388	
	xi) Jasmine yellow	397	
	xii) Light salmon pink	442	
	xiii) Salmon pink	443	
18	Primrose	354	Primrose
19	Light buff	358	Light buff
20	i) Middle buff	359	
	ii) Deep buff	360	Deep buff
	iii) Middle stone	362	
21	i) Dark stone	363	
	ii) Light brown	410	
	iii) Middle brown	411	Light brown
	iv) Golden brown	414	
	v) India brown	415	
	vi) Leaf brown	489	
22	i) Dark brown	412	
	ii) Orange brown	439	
	iii) Venetian red	445	
	iv) Red oxide	446	Gulf red
	v) Deep Indian red	448	
	vi) Light purple brown	449	
	vii) Gulf red	473	
	viii) Beech brown	490	
23	i) Nut brown	413	
	ii) Chocolate	451	Nut brown
	iii) Service brown	499	
24	Terra cotta	444	Terra cotta
25	i) Fire red	536	
	ii) Signal red	537	
	iii) Post office red	538	Post office red
	iv) Crimson	540	or Signal red
	v) International orange	592	
26	Maroon	541	Maroon
27	i) Traffic yellow	368	
	ii) Light orange	557	Deep orange
	iii) Traffic red	570	
	iv) Deep orange	591	
28	India saffron	574	India saffron
29	i) Silver grey	628	
	ii) Quaker grey	629	
	iii) French grey	630	
	iv) Light grey	631	
	v) Dark admiral grey	632	Light grey and
	vi) Smoke grey	692	Aircraft grey
	vii) Aircraft grey	693	
	viii) Dove grey	694	
30	i) RAF blue grey	633	
	ii) Slate	634	
	iii) Lead	635	RAF blue grey
	iv) Middle graphite	671	
	v) Dark blue grey	695	

6 REQUIREMENTS

6.1 Composition

The material shall be based on synthetic resins, free from natural resins or their derivatives or their modifications, in any form when tested in accordance with IS 101(Part 9/Sec 2). It shall be of such a composition as to satisfy the requirements of this standard.

The compositions of the pigment and the vehicle of the bulk supply shall be similar to those of the registered sample, if any, within the permissible limits specified in this standard.

6.1.1 The quantity of each of the major constituent of the pigment composition and the total quantity of extenders in the pigment composition of the bulk supply and that of the registered sample, if any, shall not deviate by more than ± 25 percent by mass of the recorded data on the registered sample, for pigment composition and the total quantity of extenders separately, when the supply is of a shade different from the registered sample but in the same colour category. However, when the bulk supply is of the same shade as that of the registered sample the deviation shall not be more than ±15 percent by mass of the recorded data on the registered sample.

NOTE — Any constituent of the pigment showing 20 percent and more by mass of the total pigment composition shall be considered a major constituent of the pigment composition.

6.1.1.1 These limits for extender shall apply even if the extender is not a major constituent of the pigment composition. Any silicious and/or extraneous matter present to the extent of 0.5 percent by mass on paint if absent in bulk supply shall not be the cause for rejection.

6.1.1.2 When no extender is present in the pigment composition of the registered sample, if any, not more than 5 percent by mass of silicious matter on the pigment composition shall be allowed in the bulk supply.

6.1.2 In undercoating the sum total of genuine pigments shall not deviate by more than ±25 percent by mass of the data recorded on the registered sample, if any, between the registered sample and the bulk supply, when the supply is of a different shade from the registered sample but in the same colour category. However, when the bulk supply is of a different shade from the registered sample the deviation shall not be more than 15 percent by mass of the data recorded on the registered sample.

6.1.3 The total non-volatile matter which includes pigments and vehicle solids, shall not deviate by more than ±10 percent by mass of the recorded data on the

registered sample if any. This applies to both undercoating and finishing enamels for the same as well as different shade within the same colour category as that of the registered sample.

6.1.4 The total pigment content of the bulk supply shall not deviate by more than ±15 percent by mass of the data recorded on the registered sample, if any, when the supply is of the same shade as that of the registered sample. When the bulk supply is of a shade different from that of the registered sample, the deviation allowed shall be ± 25 percent by mass of the data recorded on the registered sample.

6.1.5 The vehicle of the enamel shall essentially consist of a drying oil modified alkyd resin with suitable thinner and driers. On analysis the non-volatile vehicle shall yield not less than 25 percent by mass of phthalic anhydride when estimated by the method prescribed in IS 354 (Part 2). It shall, however, not deviate by more than ±10 percent by mass in the bulk supply as compared to recorded data on the registered sample, if any.

6.2 Durability

6.2.1 *Registered Sample*

6.2.1.1 When prepared and tested as prescribed under **B-3** up to a period of 12 months preferably at National Test House, Calcutta, film prepared from the sample for registration of the material shall satisfy the requirement of the test.

6.2.1.2 A film of the sample for registration shall be prepared and tested in an accelerated weathering apparatus using xenon arc, as prescribed under **B-4** and examined every third day for a period of 700 h and a complete record of its performance maintained.

NOTES

1 As a precaution against inadvertent accidents, it is recommended that the normal outdoor exposure test (*see* **B-3**) and the accelerated weathering test (*see* **B-4**) are carried out in duplicate.

2 For details of method of tests for xenon arc apparatus follow **5** of IS 101 (Part 6/Sec 5).

6.2.2 *Sample from Bulk Supply*

The characteristics of the film of the material prepared from a representative sample of the bulk supply as prescribed in **B-2**, tested in the accelerated weathering apparatus (*see* **B-4**) and examined every third day for a period of 700 h shall not deviate by more than the limits specified in **6.2.2.1** and **6.2.2.2**.

6.2.2.1 Gloss (specular 60°) retention, when tested as prescribed in IS 101(Part 4/Sec 4), of bulk supply shall be within ±10 units of that of the registered sample, if any.

NOTE — At any time during the weatherometer test, the percentage value of gloss (specular 60°) retention of the bulk supply sample shall not vary by more than ±10 units from the recorded data of the registered sample; for example, when the registered, sample showed 70 percent gloss retention at any particular stage of weatherometer test, the bulk supply sample shall show gloss retention of 60 to 80 percent at the corresponding stage of testing.

6.2.2.2 The results of observation on characteristics of colour, checking, chalking and spotting of bulk supply sample shall not be more than slightly different from those recorded for the registered sample, if any.

6.3 Mass in kg per 10 Litre

The minimum mass in kg/10 litre of the material shall be within ±3 percent when the shade is the same as the registered sample and ±5 percent when the shade is different from the registered sample but within the same shade category. In no case, however, the mass per 10 litre shall be less than the stipulated minimum as mentioned in Table 2.

6.4 Lead Restriction

6.4.1 The material shall not contain lead or compounds of lead or mixtures of both, calculated as metallic lead more than 300 ppm, when tested for restriction from lead in accordance with IS 101 (Part 8/Sec 5).

6.5 The material shall also comply with the requirements given in Table 2.

7 PACKING AND MARKING

7.1 Packing

Unless otherwise agreed to between the purchaser and the supplier, the enamel shall be packed in suitable metal containers (*see* IS 1407 and IS 2552). The packing is subject to the provisions of the law in force in the country at that time.

7.2 Marking

7.2.1 Each container shall be marked with the following:

a) Name of the material and indication whether undercoating or finishing;

b) Indication of the source of manufacture;

c) Lead content, *Max*;

d) A statement “synthetic”, if the material contains phthalic anhydride;

d) Volume of the material;

e) Batch number or Lot number in code or otherwise;

f) Month and year of manufacture;

g) Colour/ shade of the material; and

Table 2 Requirement for Enamel, Synthetic, Exterior, Air Drying, for Use on Primed Surfaces of Motor Vehicles and Other Equipment

(*Clauses* 6.3 *and* 6.5)

Sl No.	Characteristics	Requirements		Methods of Test	
		Undercoating	Finishing	Ref to IS 101	Annex of this standard
(1)	(2)	(3)	(4)	(5)	(6)
i)	Drying time, h, *Max*			(Part 3/Sec 1)	—
	a) Surface dry	2	2		
	b) Hard dry	8	8		
	c) Tack free	—	24		
ii)	Consistency	Smooth, uniform and suitable for brushing without appreciable drag on the brush		—	C
iii)	Mass, in kg/10 litres, *Min*	12.0	8.5	(Part l/Sec 7)	—
iv)	Finish	Smooth and matt to egg shell gloss	Smooth and glossy	(Part 3/Sec 4)	—
v)	Colour	Approximate match to the finishing enamel	Close match to the specified IS colour as in IS 5 or to an agreed colour where IS colour is not specified	(Part 4/Sec 2)	—
vi)	Wet opacity *Min,* m^2/10 litre	Between –10 percent and + 20 percent of the registered sample		(Part 4/Sec 1)	—
vii)	Water content (if water is suspected to be present)	0.5	0.5	(Part 2/Sec 1)	—
viii)	Flexibility and adhesion	No such scratch as to show the bare metal		**3** of (Part 5/Sec 2)	—
	a) Scratch hardness, (Load 1 000 g)				
	b) Bend test, (with 6.25 mm dia mandrel in Type 1 apparatus)	No visible damage detachment after		**2** of (Part 5/Sec 2)	—
ix)	Impact resistance	—	To pass the test	—	D
x)	Flash point	Not below 30°C	Not below 30°C	(Part l/Sec 6)	—
xi)	Stripping test	Scratches free from jagged edges		—	E
xii)	Composition: Phthalic anhydride content of non-volatile vehicle, percent by mass, *Min*	25	25	—	**11** of IS 354 (Part 2)
xiii)	Resistance to humidity under conditions of condensation	—	No signs of corrosion	**2** of (Part 6/Sec 1)	—
xiv)	Resistance to petrol	—	To pass the test	—	F
xv)	Resistance to lubricating oil	—	To pass the test	—	F
xvi)	Resistance to heat	—	To pass the test	—	G
xvii)	Resistance to water and soap spotting	—	To pass the test	—	H
xviii)	Keeping properties	Not less than one year from the date of manufacturing		(Part 6/Sec 2)	—

h) A cautionary note as below

1) Kee out of reach of children.
2) Dried film of this paint may be harmful if eaten or chewed.
3) This product may be harmful if swallowed or inhaled.

7.2.2 *BIS Certification Marking*

The container may also be marked with the Standard Mark.

7.2.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standard Act,* 2016 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

8 SAMPLING

8.1 Preparation of Test Samples

8.1.1 *For Registration*

The sample shall be submitted in three different

containers each containing not less than 500 ml of the material.

8.1.1.1 As testing to the requirements of this standard covers a period of 12 months, the supplier is advised to submit samples for registration sufficiently in advance within the period from *October to December* of the year, so that outdoor exposure test can be started during the period stipulated in **B-3.1**.

8.1.2 *Tender Sample*

The supplier may dispense with sending a tender sample provided that he declares that the material for which the tender is given is of the same quality as the sample previously registered in his name.

8.1.3 *Bulk Supply Sample*

Representative samples of the material shall be drawn and treated as prescribed under **3** of IS 10l (Part 1/Sec 1).

8.1.4 *For Drying Time and Resistance to Heat Test*

Prepare mild steel panel of sizes 150 mm × 100 mm × 1.25 mm as prescribed in **2** of IS 101 (Part 1/Sec 3). Apply the paint on each side of the panel uniformly by brushing to give a dry film mass commensurate with the mass per 10 litre as specified in Table 1 of IS 101(Part 3/Sec 4). Prepared test panel then subjected to the test as specified in IS 101 (Part 3/Sec 1) as soon as possible.

8.1.5 *For Flexibility and Adhesion Test, Stripping Test*

For all these tests, prepare separate burnished tin plate panels, rectangular, of sizes 100 mm × 50 mm × 0.3 mm as prescribed in **3** of IS 101 (Part 1/Sec 3). Apply one coat of material uniformly by brushing on the panels as to give a dry film mass commensurate with the mass per 10 litre as specified in Table 1 of IS 101(Part 3/Sec 4). The coated test panels shall be air dried for 48 h for bend test for undercoating, scratch hardness test and striping test. Wherein coated test panels for bend test for finishing shall be air dried for 96 h and then be cooled for 6 h at 0°C. All the panels after drying shall be conditioned at a temperature of 27° ± 2°C and relative humidity of 65 ± 5 percent for a minimum time of 16 h. Prepared test panels then subjected to the tests as prescribed in **2** and **3** of IS 101(Part 5/Sec 2) for bend test and scratch hardness test respectively and as prescribed in Annex E for stripping test.

8.2 Criteria for Conformity

A lot shall be declared conforming to the requirements of this standard if the test results on the composite sample satisfy the requirements prescribed under **5**.

9 TEST METHODS

9.1. Tests shall be conducted as prescribed in **6.1** to **6.5** and the methods referred in co1 5 and 6 of Table 2.

9.2 Quality of Reagents

Unless specified otherwise 'pure chemicals' and distilled water (*see* IS 1070) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

9.3 Comparison with the performance of the registered sample, if any, shall be carried out on the basis of records maintained for the registered samples (*see* **6.2.1**).

9.4 For match against Indian Standard colours, IS 5 shall be used.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
5 : 2007	Colours for ready mixed paints and enamels (*sixth revision*)
101	Methods of sampling and test for paints, varnish and related products:
Part l	Test on liquid paints (general and physical),
Sec 1 : 1986	Sampling (*third revision*)
Sec 2 : 1987	Preliminary examination and preparation of samples for testing (*third revision*)
Sec 3 : 1986	Preparation of panels (*third revision*)
Sec 5 : 1989	Consistency (*third revision*)
Sec 6 : 1987	Flash point (*third revision*)
Sec 7 : 1987	Mass per 10 litres (*third revision*)
Part 2/Sec 1 : 1988	Test on liquid paints (chemical examination), Section 1 Water content (*third revision*)
Part 3	Tests on paint film formation,
Sec 1 : 1986	Drying time (*third revision*)
Sec 4 : 1987	Finish (*third revision*)
Sec 5 : 1987	Fineness of grind (*third revision*)
Part 4	Optical tests on paint films,
Sec 2 : 1989	Colour (*third revision*)
Sec 3 : 1988	Light fastness test (*third revision*)
Sec 4 : 1988	Gloss (*third revision*)
Part 5	Mechanical tests on paint films,
Sec 1 : 1988	Hardness tests (*third revision*)
Sec 2 : 1988	Flexibility and adhesion (*third revision*)
Part 6	Durability tests on paint films,
Sec 1 : 1988	Resistance to humidity under conditions of condensation (*third revision*)
Sec 2 : 1989	Keeping properties (*third revision*)
Part 7/Sec 2 : 1990	Environmental test on paint films, Section 2 Resistance to liquids (*third revision*)
Part 8	Tests for pigments and other solids
Sec 5 : 1993	Lead restriction test
Sec 6 : 1993	Volume solids
285 : 1992	Laundary soaps (*third revision*)
354 (Part 2) : 1996	Methods of sampling and test for resins for paints: Part 2 Special test methods for alkyd resins (*second revision*)
1017 : 1983	Chamois leahter (*second revision*)
1070 : 1992	Reagent grade water (*third revision*)
1303 : 1983	Glossary of terms relating to paints (*second revision*)
1407 : 1980	Round paint tins (*second revision*)
1604 : 2012	Aviation gasoline — Specification (*fourth revision*)
1745 : 1978	Petroleum hydrocarbon solvents (*second revision*)
2074 (Part 1) : 2015	Ready mixed paint, air drying, red oxisde-zinc chrome, priming — Specification: Part 1 For domestic and decorative applications (*third revision*)
2552 : 1989	Steel drums (galvanized and ungalvanized) (*third revision*)
5661 : 1970	Code of practice for packing and marking of packages of paints, enamels, varnishes and allied products

ANNEX B

(*Clauses* 6.2.1 *and* 6.2.2)

TEST FOR DURABILITY

B-1 GENERAL

B-1.1 Outline of the Method

The durability of the material is determined by ascertaining actual behaviour of suitably prepared test panels in normal outdoor exposure test for a specified period and evaluating the results of the exposure by a suitable method of rating for various characteristics of the enamel film. Apart from this, the enamel is also evaluated by an accelerated weathering test wherein a prepared panel is subjected to controlled exposure of heat, light and water in an artificial weathering apparatus.

B-2 TEST PANELS

B-2.1 The panels shall be mild steel plate and shall be

prepared as prescribed in **2** of IS 101(Part l/Sec 3). The back and edges of the panels shall be protected with two coats of a suitable paint.

B-2.1.1 *For the Outdoor Exposure Test*

Panels shall be of sizes 300 mm × 300 mm × 1.6 mm.

B-2.1.2 *For the Accelerated Weathering Test*

Panels shall be preferably of sizes 60 mm × 40 mm × 1.25 mm for Xenon arc type. However, panels may be of any other sizes suitable for accommodating in those apparatus.

B-3 PREPARATION OF TEST PANELS

B-3.1 In the painting procedure outlined under **B-3.2** the air drying of the films shall be done at room temperature and at a relative humidity of not more than 70 percent.

B-3.2 The surface of the test panels to be exposed shall be prepared as follows, taking care that total dry film thickness of the complete system shall be between 75 and 100 microns:

a) Apply uniformly one coat of ready mixed paint, air drying, red oxide-zinc phosphate, priming [conforming to IS 2074 (Part 1)] by brushing and allow to dry for 24 h;

b) Rub down lightly with waterproof emery paper No. 280/320, wipe off the surface using a piece of clean and dry soft cloth and then apply uniformly one coat of the undercoating enamel conforming to this standard by brushing and allow to air-dry for 24 h;

c) Rub down, wet, with waterproof emery paper No. 280/320, wipe off the surface using a piece of clean and dry soft cloth and then apply uniformly one coat of the finishing enamel conforming to this standard by brushing and allow to air-dry for 48 h; and

d) Rub down, wet, with waterproof emery paper No. 320, wash and wipe off water and when the surface is dry, apply uniformly a s coat of the finishing enamel by brushing and allow to air dry for 7 days before subjecting to exposure test.

NOTE — The primer, undercoat and the finishing enamels be preferably from the same source.

B-4 NORMAL OUTDOOR EXPOSURE TEST

B-4.1 Subject the samples for registration and the tender samples, if supplied, to normal outdoor exposure test in the manner described under **B-4.2**.

B-4.2 Expose in the open the test panels, prepared in the manner prescribed under **B-2** and **B-3** in duplicate in a vertical position facing South. Commence the exposure not earlier than the third week of January and not later than the first week of April.

B-4.2.1 Examine the condition of the exposed films at monthly intervals for the first quarter and thereafter quarterly for the rest of the period for the following characteristics:

a) Gloss;

b) Colour;

c) Checking, cracking and flaking;

d) Chalking; and

e) Spotting.

B-4.2.2 For the above examinations, wash the right hand half of the surface of the two test panels by pouring water and then wiping with a soft cloth or chamois leather (*see* IS 1017). Adequate time for cooling of the panels to room temperature shall be allowed prior to washing. Examine the same half of the test panels at each examination. As an aid in the examination, a magnifying glass may be used, but the evaluation shall be based on an assessment with the unaided eye. At the end of the stipulated period for durability test, examine the two halves of the test panels. The sample shall be considered satisfactory if the material surface underneath as well as condition of the film in both the halves, the one washed periodically as well as the one washed only for the final examination is satisfactory by the method of evaluation described in **B-4.3**. Stray film failure, due to extraneous causes other than climate, shall be ignored.

B-4.3 Evaluation of Unexposed Test Panels

The properties of the film of an exposed test panel shall be recorded for the following characteristics:

a) Possessing high gloss, with units of gloss reading (specular 45°);

b) Possessing correct colour (matching the stipulated shade);

c) Freedom from checking, cracking and flaking;

d) Freedom from chalking; and

e) Freedom from spotting.

B-4.4 Evaluation of Exposed Films

The requirements of this test shall be taken to have been satisfied if performance in respect of the characteristics as noted in **B-4.3** is within the limits specified in Table 3.

B-4.5 Protection Against Corrosion

After exposure of the film is discontinued, examine for corrosion of the metal surface of the panel underneath by

Table 3 Evaluation of Exposed Films

Sl No.	Characteristic	Exposure	Requirement
(1)	(2)	(3)	(4)
i)	Gloss	After 3 months	The film shall have a minimum gloss retention of 20 percent of the original value (except for colour categories No. 20, 21 and 22 where the minimum gloss retention shall be 40 percent of the original value).
		After 6 months	The film shall have a minimum gloss retention of 35 percent of the original value (except for colour categories No. 20, 21 and 22 where the minimum gloss retention shall be 25 percent of the original value) and for colour category No. 2 where the minimum shall be 50 percent of the original value.
		After 12 months	The film shall have a minimum gloss retention of 20 percent of the original value (except for colour categories No. 20, 21 and 22 where the minimum gloss is not specified), for colour category No. 24 where the minimum shall be 10 percent and for colour category No. 2 where the minimum shall be 50 percent of the original value.
ii)	Colour	After 3 months	Colour shall be satisfactory.
		After 6 months	Colour shall not be affected appreciably.
		After 12 months	Colour shall not be affected adversely.
iii)	Freedom from checking and flaking	Upto 12 months	The film shall remain generally free from checking, cracking and flaking. A few superficial isolated hair line cracks shall not constitute cause of failure.
iv)	Freedom from chalking	Upto 12 months	Slight chalking shall not constitute a cause for rejection, but heavy chalking after 12 months' exposure shall be cause for rejection.
v)	Freedom from spotting	Upto 12 months	The film shall not show considerable spotting at any time during the exposure which adversely affects the other characteristics of the film.
vi)	Freedom from blisters and corrosion	Upto 12 months	The film shall remain generally free from blisters and the metal underneath shall show no sign of corrosion, one or two localized corrosion and/or rust spots shall not constitute a cause of failure.

removing film at 5 different places, one in the centre and one each at 4 different places near the 4 corners about 50 mm away from the edges. The paint film shall be removed by solvent type paint remover. When the film is softened by the paint remover it shall be removed by gently rubbing with cotton swab or waste jute taking care to remove adhering film of primer and/or undercoating. After removal of the film, the exposed metal shall be covered by thick mineral oil or petroleum jelly. Localized corrosion and or one or two rust spots shall not constitute a cause of failure. To satisfy the requirements of this standard, the metal surface shall be otherwise free from corrosion.

B-5 ACCELERATED WEATHERING TEST

B-5.1 Accelerated Weathering Apparatus

An artificial weathering apparatus of the Xenon/carbon arc type for uniform and controlled exposure to the effects of heat, light and water.

B-5.2 Procedure

B-5.2.1 The panel for this test shall be prepared as described under **B-3.2**. Samples for registration, if any, shall be tested in duplicate in a suitable accelerated weathering apparatus (*see* **B-5.1**) and samples drawn from the bulk supply shall be tested in a similar manner.

B-5.2.2 Commonly used cycles and test conditions for Xenon arc apparatus are given below:

a) Black panel temperature 63° ± 3°C;

b) Continuous exposure in light for 102 min and intermittent exposure to water spray for 18/20 min light and spray; and

c) Irradiance 0.55 W/m^2/nm.

However, any other cycle may be used if mutually agreed upon between the purchaser and the supplier.

B-5.2.3 The exposed film shall be evaluated for gloss and various film properties as prescribed under **B-4.4**.

B-5.2.4 The requirement of this test on a sample from bulk supply shall be taken to have been satisfied if the gloss retention shall be minimum 40 percent of the original and the performance in respect of the other film characteristics is generally similar to that obtained with the registered sample, if any.

ANNEX C

[*Table* 2, *Sl No*. (ii)]

CONSISTENCY

C-1 APPARATUS

C-1.1 Palette Knife or Metal Rod

C-1.2 Panels

C-1.2.1 Unless specified otherwise, glass panels of size 150 mm × 50 mm shall be prepared as prescribed in **5** of IS 101 (Part 1/Sec 3).

C-2 PROCEDURE

C-2.1 Insert a clean metal rod or palette knife into the original container and examine the nature of settling.

C-2.2 Observations

The material shall not form a hard cake inside the container and shall be in such a condition that stirring easily produces a smooth uniform paint suitable for brushing on glass panels.

ANNEX D

[*Table* 2, *Sl No.*(ix)]

TEST FOR IMPACT RESISTANCE

D-1 GENERAL

D-1.1 Outline of Method

The painted panel is subjected to impact test using a free falling ball and film examined for deterioration.

D-2 TEST PANELS

At least four panels of mild steel plate of sizes 300 mm × 300 mm × 1.6 mm shall be prepared as prescribed in **2** of IS 101(Part l/Sec 3).

D-3 PREPARATION OF TEST PANELS

D-3.1 In the painting procedure outlined under **D-3.2**, the air drying of the films shall be done at room temperature and at a relative humidity of not more than 70 percent.

D-3.2 The surface of the test panels to be exposed shall be prepared as in (a), (b), (c) and (d) of **B-3.2**, taking care that total dry film thickness of the complete system shall be about 50 microns. The sample panel shall be conditioned at a temperature of 27° ± 2°C and relative humidity of 65 ± 5 percent for a minimum time of 16 h.

D-4 PROCEDURE

D-4.1 Follow the Method B of IS 101(Part 5/Sec 3) for all four panels.

D-4.2 Utilizing the same panels, age in an oven at a temperature of 60°C for 10 days and repeat the impact test.

D-4.3 Observations

The panel shall not show any signs of deterioration of the paint film.

ANNEX E

[*Table* 2, *Sl No.* (xi) *and* Clause 8.1.5]

STRIPPING TEST

E-1 OUTLINE OF THE METHOD

The minimum load required to produce a scratch showing the bare metal surface of the panel painted with the material is determined.

E-2 APPARATUS

The apparatus used for determining scratch hardness as prescribed in **3.2.2** of IS 101 (Part 5/Sec 2) shall be used.

E-2.1 Preparation of Test Panels

Tin panels as described under **8.1.5** shall be prepared.

E-2.2 Test the dried film in the apparatus under such a load that a scratch is produced showing the bare metal surface.

E-3 OBSERVATIONS

The paint shall be deemed to have passed the test if the scratch so produced shall be free from jagged edges.

ANNEX F

[*Table* 2, *Sl No.*(xiv) *and* (xv)]

TEST FOR RESISTANCE TO PETROL AND LUBRICATING OIL

F-1 OUTLINE OF THE METHOD

The painted panels, after specified drying period, is dipped in petrol and lubricated oil separately and at specified temperature and time. On completion of the specified time periods, the panels are subjected for visual examination.

F-2 PREPARATION OF TEST PANELS

Prepare mild steel plate panel as prescribed in **8.1.4**. The back and edges of the panels shall be protected with two coats of a suitable paint. The coated test pieces shall be air dried in a horizontal position for 7 days and shall be conditioned as described in **3.3** of IS 101(Part 7/Sec 2).

F-3 REAGENTS

F-3.1 100 Octane Aviation Gasoline (*see* IS 1604).

F-3.2 Lubricating Oil

Mineral lubricating oil having a viscosity of 18.0 cSt or having a time of flow of approximately 80 s for 50 ml in a No.1 Redwood Viscometer.

F-4 PROCEDURE

F-4.1 Follow the procedure as prescribed in **4** of IS 101 (Part 7/Sec 2). Immerse one prepared panel in gasoline (*see* **E-2.1**) at room temperature for 15 min.

F-4.1.1 Take out the panel from gasoline and allow the panel to stand in a vertical position for 5 min at room temperature and then swab it vigorously for about 5 s with a pad of cotton wool. Observe the paint films after cooling for 30 min at room temperature.

F-4.2 Follow the procedure as prescribed in **4** of IS 101 (Part 7/Sec 2). Immerse one prepared panel in lubricating oil (*see* **E-2.2**) at 50°C for 2 h.

F-4.2.1 Take out the panel from the oil and remove any residual lubricating oil from the surface by dabbing with a suitable absorbent paper or cloth or a pad of cotton wool and examine the test piece after a recovery period of 30 min at room temperature.

F-5 OBSERVATIONS

The sample shall be treated as passing if there is no blistering, flaking and corrosion. The material shall be deemed to have passed the test if the film shall not show signs of disintegration, permanent injury or change of colour to a greater extent. The loss of gloss shall not be more than 50 percent of the original gloss.

ANNEX G

[*Table* 2, *Sl No.*(xvi)]

DETERMINATION OF RESISTANCE TO HEAT

G-1 OUTLINE OF THE METHOD

An air-dried panel is heated to a maximum temperature under stipulated conditions. After this, it is cooled and dipped in water. The extent of deterioration of the film is examined and also may be compared with that of an approved sample (if any) tested at the same time.

G-2 APPARATUS

G-2.1 Electric Furnace

With a maximum attainable temperature of 900°C. It is equipped with a 3 500 W heating element which operates on a single phase alternating current of approximately 15 A at 50 cycles/second, Hz on a voltage of 240 of the minimum dimensions of the heating chamber are 380 mm × 150 mm × 80 mm.

G-3 PROCEDURE

G-3.1 Prepare steel panel as described in **8.1.4**. Allow the panel to air-dry in a horizontal position at a temperature of 27° ± 2°C and relative humidity of 65 ± 5 percent for a minimum time of 24 h. Heat the panel in a vertical position in an electrical furnace, the temperature of which is gradually raised from room temperature up to a temperature of 300°C in 1½ h time. Maintain the panel at the maximum temperature of 300°C for 2 h. Remove the panel from the furnace, cool to room temperature and immerse in water at room temperature for 24 h. Take out the panel and examine it after air-drying for 1 h.

G-3.2 Observations

The material shall be deemed to have passed the test if the paint film remains firmly adherent and shows no sign of cracking, blistering or flaking. Formation of hair-lines shall not be a cause for rejection. For bulk supplies, the deterioration, if any, shall not be greater than that shown by the registered/approved sample, if any.

ANNEX H

[*Table* 2, *Sl No.* (xvii)]

DETERMINATION OF RESISTANCE TO WATER AND SOAP SPOTTING

H-1 GENERAL

H-1.1 Outline of Method

The painted panel is subjected to normal outdoor exposure for a specified period and then subjected to ware and soap solution spotting. After keeping the panel in sunlight for a specified period the paint film is examined.

H-2 TEST PANELS

At least two panels of mild steel plate of sizes 300 mm × 300 mm × 1.6 mm shall be prepared as prescribed in **2** of IS 101(Part l/Sec 3).

H-3 PREPARATION OF TEST PANELS

H-3.1 In the painting procedure outlined under **G-3.2**, the air drying of the films shall be done at room temperature and at a relative humidity of not more than 70 percent.

H-3.2 The surface of the test panels to be exposed shall be prepared as in (a), (b), (c) and (d) of **B-3.2**, taking care that total dry film thickness of the complete system shall be about 50 microns.

H-4 PROCEDURE

H-4.1 Ensure to carry out this test at laboratory temperature.

H-4.2 On each panel place two cotton pads of 4 cm diameter, one soaked with water and other soaked with one percent soaps solution (conforming to IS 285) to be referred a spotted zone. Cover the pads with watch glass and keep it exposed in sunlight for 4 h.

H-4.3 Remove the pads, wash with running water and remove any residual liquid from the surface by a clean cloth. Allow to dry for 1 h.

H-4.4 Observations

Examine visually any change in colour in spotted zones. The material shall be deemed to have passed the test if the film does not show any change in colour in spotted zones.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc No.: CHD 20 (2081).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.org.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 — 2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi, KOLKATA 700054 — 2337 8499, 2337 8561, 2337 8626, 2337 9120

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, CHANDIGARH 160019 — 26 50206, 265 0290

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 — 2254 1216, 2254 1442, 2254 2519, 2254 2315

Western : Manakalaya, E9 MIDC, Marol, Andheri (East), MUMBAI 400093 — 2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches: AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi